frequency and bandwidth with the additional capability for independent phase and amplitude modulation.

Each of these UWB transmitters can operate at extremely high data rates, enabling the transmission of high speed data such as real-time digitized video, multiple simultaneous digital voice channels, or other information, as well as enabling a range measuring device to transmit ~~the transmission of~~ high PRF pulse trains for radar or ranging applications.

To achieve high power output from any of these UWB sources, a gated power amplifier is used (Fig. 8). The gated power amplifier has the unique feature of high power efficiency as the power amplifier is only turned on for approximately the duration of the UWB pulse.

As a receiver, a microwave tunnel diode is utilized as a single pulse detector for short pulse, impulse, baseband or ultra wideband signals. The UWB receiver has a number of unique features which permit highly sensitive operation at extremely high speeds (multiple Mb/s) with high immunity to in-band jamming.

For instance, the tunnel diode detector bias point is preferably determined only once, and preferably at system start-up, through an automatic calibration procedure. In this fashion, the tunnel diode detector is set to its highest sensitivity point relative to the desired bit error rate performance based upon internal noise only, and remains at that point during the entire reception process. Conventional CFAR-based UWB receivers continually update the detector bias point, resulting in reduced detector sensitivity in the presence of in-band jamming (i.e., receiver back-off), and extremely slow response times because of the need to constantly recalculate the false alarm rate. Rather than adjust the bias to the tunnel diode detector, the present

modifications to the described embodiments of the invention without departing from the true spirit and scope of the invention, including without limitation, a method of detecting an object by generating a switched impulse, low-level ultra-wideband signal; waveform adapting the switched impulse, low-level ultra-wideband signal; and transmitting to and receiving a reflected pulse from an object representative of the waveform-adapted, ultra-wideband signal.

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pulse, a recovery period is nevertheless required before a subsequent pulse may be detected.

Outputs from the DTDD 20 are latched and passed to a time detector circuitry 24 within the digital processor submodule 22. The time detector 24 measures or detects the relative time difference of arrival between the locally generated transmit pulse (local reference) and each detected return pulse(s) that is reflected from an object. This time difference information is subsequently forwarded to a controller, microcontroller, or digital signal processor (DSP) (i.e., distance calculation circuit 26) to convert the time difference, i.e., delta time of arrival, into a distance measurement. A system timing circuit 28, preferably within the digital processor module 22, generates reference clock pulses (Fig. 4(a)) which are used to initiate pulse transmission by UWB transmitter 12 and for timing the operations of the RF receiver module 18, DTDD 20 and time detector 24.

Fig. 2 is a block diagram of the dual tunnel diode detector module. Each of the tunnel diode detectors 32 and 34 is similar to that described in U.S. Appln. No. 08/872,729 (incorporated herein), and includes a self-calibrating bias control circuit that maintains a desired constant false alarm rate (CFAR). In the transmit TDD 34, the signal-to-noise ratio is very high and the tunnel bias can be reduced to guarantee a negligibly small false alarm rate. As described in U.S. Appln. No. 08/872,729, outputs of the tunnel diodes are latched by the circuit shown in Fig. 3 and are maintained at logic one levels until the devices are physically reset.

A high speed RF switch 36 initially couples the output from the RF Module 18 (Fig. 1)(and thus from the receive antenna) to the "transmit" (TX) tunnel diode detector 34 in order to capture the primary transmit UWB pulse directly

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